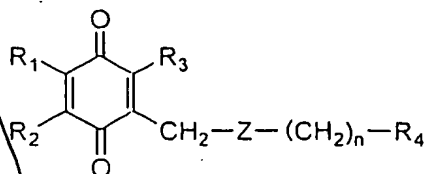


CLAIMS

*composition*

1. An NF-kB inhibitor comprising as an active ingredient a benzoquinone derivative represented by the following general formula (1):



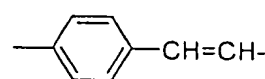
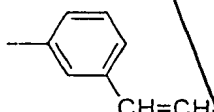
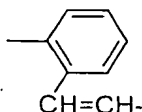
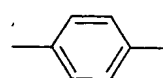
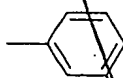
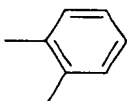
(1)

wherein

R<sub>1</sub>, R<sub>2</sub>, and R<sub>3</sub> are each independently a hydrogen atom, an alkyl group having 1 to 5 carbons, or an alkoxy group having 1 to 5 carbons;

R<sub>4</sub> is a hydrogen atom, a hydroxymethyl group, an alkyl group, or a carboxyl group which is optionally esterified or amidated;

Z is



and, n is an integer from 0 to 6, or its hydroquinone form, or a pharmaceutically acceptable salt thereof.

*composition*

2. The NF-kB inhibitor according to claim 1 ~~in which~~ wherein R<sub>1</sub> and R<sub>2</sub> are a hydrogen atom, a methyl group, or a methoxy group.

*composition*

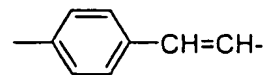
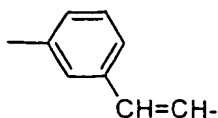
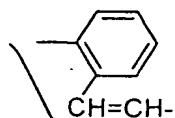
3. The NF-kB inhibitor according to claim 1 ~~or 2~~ wherein R<sub>3</sub> is a hydrogen atom or a methyl group.

*composition*

4. The NF-kB inhibitor according to claim 1, 2, or 3 wherein Z is

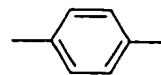
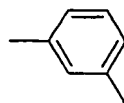
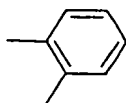
^

a B 30  
a  
C2  
a B  
a B 35  
a



and n is an integer 0.

5. The NF- $\kappa$ B inhibitor according to claim 1, 2, or 3 wherein Z is



and n is an integer 1, 2, or 3.

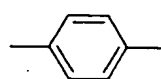
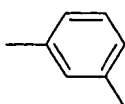
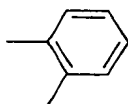
6. The NF- $\kappa$ B inhibitor according to any one of claims 1 to 5 in which  $R_4$  is a group  $-COOR_5$ , wherein  $R_5$  is a hydrogen atom, an optionally substituted alkyl group having 1 to 8 carbons, an optionally substituted phenyl group, or an optionally substituted aralkyl group having 7 to 11 carbons.

7. The NF- $\kappa$ B inhibitor according to any one of claims 1 to 5 in which  $R_4$  is a group  $-CONR_6R_7$ , wherein  $R_6$  and  $R_7$  are each independently a hydrogen atom, an optionally substituted alkyl group having 1 to 8 carbons, an optionally substituted bicyclic unsaturated or partially saturated hydrocarbon ring group having 9 to 11 carbons, an optionally substituted heterocyclic group, an optionally substituted phenyl group, an optionally substituted aralkyl group having 7 to 11 carbons, or a heteroaryl- $C_1$ - $C_3$ -alkyl group, or  $R_6$  and  $R_7$ , together with the nitrogen atom to which they are attached, represent a heterocyclic group which may further contain a nitrogen, oxygen, and/or sulfur atom.

8. The NF- $\kappa$ B inhibitor according to any one of claims 1 to 5 in which  $R_4$  is a group  $-CONR_6R_7$ , wherein  $R_6$  and  $R_7$ , together with the nitrogen atom to which they are attached, represent a 5- to 10-membered optionally

substituted, nitrogen-containing heterocyclic group which may contain, in addition to the carbon and nitrogen atom, 1 to 3 heteroatoms selected from the group consisting of a nitrogen, oxygen and sulfur atom, the carbon atom on said cyclic group being optionally a ketone form or the sulfur atom on said cyclic group being optionally an oxide form.

9. The NF- $\kappa$ B inhibitor according to claim 1, ~~6, 7, 8~~ wherein <sup>Composition</sup> ~~in which~~ <sup>^</sup>  $R_1$  and  $R_2$  are a methyl group or a methoxy group;  $R_3$  is a methyl group;  $R_4$  is a carboxyl group which is optionally esterified or amidated; Z is



and n is an integer 1, 2, or 3.

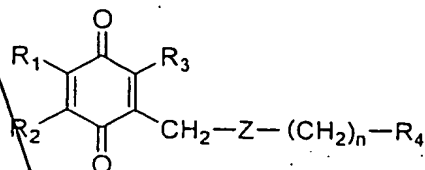
10. The NF- $\kappa$ B inhibitor according to ~~any one of~~ <sup>Composition</sup> ~~claims 1 to 9~~ <sup>^</sup> wherein the ~~is~~ <sup>is</sup> ~~suppressing agent~~ <sup>is</sup> for the gene expression of one or more substances selected from the group consisting of IL-1, TNF- $\alpha$ , IL-2, IL-6, IL-8, iNOS, granulocyte colony-stimulating factor, interferon- $\beta$ , ICAM-1, VCAM-1, ELAM-1, major histocompatibility system class I, major histocompatibility system class II,  $\beta$ 2-microglobulin, immunoglobulin light chain, serum amyloid A, angiotensinogen, complement B, complement C4, c-myc, HIV, HTLV-1, SV40, CMV, and adenovirus.

11. The NF- $\kappa$ B inhibitor according to ~~any one of~~ <sup>Composition</sup> ~~claims 1 to 9~~ <sup>^</sup> which is a preventive or therapeutic agent for inflammatory diseases.

12. The NF- $\kappa$ B inhibitor according to ~~any one of~~ <sup>Composition</sup> ~~claims 1 to 9~~ <sup>^</sup> which is a preventive or therapeutic agent for autoimmune diseases.

13. The NF- $\kappa$ B inhibitor according to ~~any one of~~ <sup>Composition</sup> ~~claims 1 to 9~~ <sup>^</sup> which is a preventive or therapeutic agent for viral diseases.

14. A preventive or therapeutic agent for diseases caused by the activation of NF- $\kappa$ B comprising as an active ingredient a benzoquinone derivative represented by the following general formula (1):



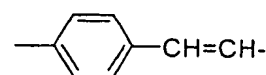
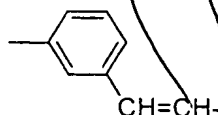
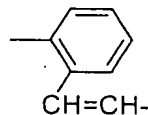
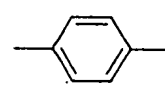
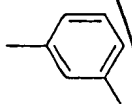
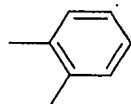
(I)

wherein

$R_1$ ,  $R_2$ , and  $R_3$  are each independently a hydrogen atom, an alkyl group having 1 to 5 carbons, or an alkoxy group having 1 to 5 carbons;

$R_4$  is a hydrogen atom, a hydroxymethyl group, an alkyl group, or a carboxyl group which is optionally esterified or amidated;

Z is



and, n is an integer from 0 to 6, or its hydroquinone form, or a pharmaceutically acceptable salt thereof.

15. A novel compound selected from:

N-[3-[4-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenyl]propionyl]morpholine,

N-[3-[4-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenyl]propionyl]thiomorpholine S-oxide,

N-[3-[4-(5,6-dimethoxy-3-methyl-1,4-

push  
C3

C<sup>3</sup>  
cont<sup>5</sup>

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N-[3-[4-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenyl]acryloyl]thiomorpholine.

N-[3-[4-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenyl]acryloyl]dimethylamine,

N-[3-[4-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenyl]acryloyl]isopropylamine,

N-[3-[4-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenyl]acryloyl]ethanolamine,

N-[3-[4-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenyl]acryloyl]benzylamine,

N-[3-[4-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenyl]acryloyl]phenethylamine,

N-[3-[3-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenyl]propionyl]piperidine,

N-[3-[3-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenyl]propionyl]thiomorpholine,

N-[3-[3-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenyl]propionyl]morpholine,

N-[3-[3-(5,6-dimethoxy-3-methyl-1,4-

~~benzoquinon-2-ylmethyl)phenyl]propionyl]isopropylamine,  
3-[3-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-  
ylmethyl)phenyl]acrylic acid,~~

N-[3-[3-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenyl]acryloyl]piperidine,

N-[3-[3-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-yl)methyl]phenyl]acryloyl]morpholine,

N-[3-[3-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenyl]acryloyl]isopropylamine,

N-[3-[3-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenyl]acryloyl]thiomorpholine,

N-[3-[4-(3,5,6-trimethyl-1,4-benzoquinon-2-ylmethyl)phenyl]propionyl]isopropylamine,

N-[3-[4-(3,5,6-trimethyl-1,4-benzoquinon-2-ylmethyl)phenyl]propionyl]piperidine,

N-[3-[4-(3,5,6-trimethyl-1,4-benzoquinon-2-ylmethyl)phenyl]propionyl]morpholine,

N-[3-[3-(3,5,6-trimethyl-1,4-benzoquinon-2-ylmethyl)phenyl]propionyl]isopropylamine,

N-[3-[3-(3,5,6-trimethyl-1,4-benzoquinon-2-ylmethyl)phenyl]propionyl]piperidine,

3-[2-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenyl]acrylic acid,

N-[3-[2-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenyl]acryloyl]thiomorpholine,

3-[2-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenyl]propionic acid,

N-[3-[2-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenyl]propionyl]piperidine,

N-[3-[2-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenyl]propionyl]morpholine,

N-[3-[2-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenyl]propionyl]thiomorpholine,

N-[3-[2-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenyl]propionyl]isopropylamine,

N-[3-[4-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenyl]propionyl]-(s)-2-

$$C_{cont}^3$$

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N-[3-[4-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenyl]propionyl]-(s)-(-)-1-phenylethylamine,

N-[3-[4-(5,6-dimethoxy-3-methyl-1,4-

benzoquinon-2-ylmethyl)phenyl]propionyl]-(R)-(+)-1-phenylethylamine,

N-[3-[4-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenyl]propionyl]-1,3-dimethylbutylamine,

N-[3-[4-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenyl]propionyl]cycloheptylamine,

N-[3-[4-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenyl]propionyl]-3,5-dimethylpiperidine,

1-[3-[4-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenyl]propionyl]-4-ethoxycarbonylpiperazine,

1-[3-[4-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenyl]propionyl]-4-phenylpiperazine,

1-[3-[4-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenyl]propionyl]-4-hydroxy-4-phenylpiperidine,

1-[3-[4-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenyl]propionyl]-4-(4-chlorophenyl)-4-hydroxypiperidine,

1-[3-[4-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenyl]propionyl]-4-(2-methoxyphenyl)piperazine,

N-[3-[4-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenyl]propionyl]-6,7-dimethoxy-1,2,3,4-tetrahydroisoquinoline,

4-acetyl-4-phenyl-1-[3-[4-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenyl]propionyl]piperidine,

N-[3-[4-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenyl]propionyl]-1,2,3,4-tetrahydroisoquinoline,

N-[3-[4-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenyl]propionyl]isoamylamine,

N-[3-[4-(5,6-dimethoxy-3-methyl-1,4-

C3  
cont 5

benzoquinon-2-ylmethyl)phenyl]propionyl]cyclohexylamine,  
N-[3-[4-(5,6-dimethoxy-3-methyl-1,4-  
benzoquinon-2-ylmethyl)phenyl]propionyl]-4-  
hydroxyaniline,  
4-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-  
ylmethyl)benzoic acid,  
N-[4-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-  
ylmethyl)benzoyl]morpholine,  
N-[4-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-  
ylmethyl)benzoyl]isopropylamine,  
N-[4-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-  
ylmethyl)benzoyl]piperidine,  
N-[4-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-  
ylmethyl)benzoyl]thiomorpholine,  
3-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-  
ylmethyl)benzoic acid,  
N-[3-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-  
ylmethyl)benzoyl]isopropylamine,  
N-[3-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-  
ylmethyl)piperidine,  
N-[3-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-  
ylmethyl)morpholine,  
N-[3-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-  
ylmethyl)thiomorpholine,  
4-[4-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-  
ylmethyl)phenyl]-n-butyric acid,  
N-[4-[4-(5,6-dimethoxy-3-methyl-1,4-  
benzoquinon-2-ylmethyl)phenyl]butanoyl]morpholine,  
N-[4-[4-(5,6-dimethoxy-3-methyl-1,4-  
benzoquinon-2-ylmethyl)phenyl]butanoyl]thiomorpholine,  
N-[4-[4-(5,6-dimethoxy-3-methyl-1,4-  
benzoquinon-2-ylmethyl)phenyl]butanoyl]piperidine,  
N-[4-[4-(5,6-dimethoxy-3-methyl-1,4-  
benzoquinon-2-ylmethyl)phenyl]butanoyl]isopropylamine,  
4-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-  
ylmethyl)phenylacetic acid,  
N-[4-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-

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C3  
cont

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DATE 08-11-2010 BY 60322 UCBAW

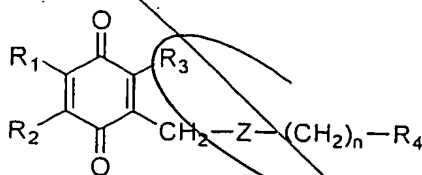
C3  
cont

ylmethyl)phenylacetyl]morpholine,  
N-[4-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenylacetyl]piperidine,  
N-[4-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenylacetyl]thiomorpholine,  
N-[4-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenylacetyl]isopropylamine,  
3-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenylacetic acid,  
10 N-[3-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenylacetyl]piperidine,  
N-[3-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenylacetyl]thiomorpholine,  
N-[3-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenylacetyl]morpholine,  
15 N-[3-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenylacetyl]morpholine,  
4-[3-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenyl]-n-butyric acid,  
20 N-[4-[3-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenyl]butanoyl]piperidine,  
N-[4-[3-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenyl]butanoyl]thiomorpholine,  
N-[4-[3-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenyl]butanoyl]morpholine, and  
25 N-[4-[3-(5,6-dimethoxy-3-methyl-1,4-benzoquinon-2-ylmethyl)phenyl]butanoyl]isopropylamine.

B

16. An ~~inhibitor~~ <sup>inhibitor composition</sup> of TNF- $\alpha$  production comprising as an active ingredient a benzoquinone derivative represented by the following general formula (1):

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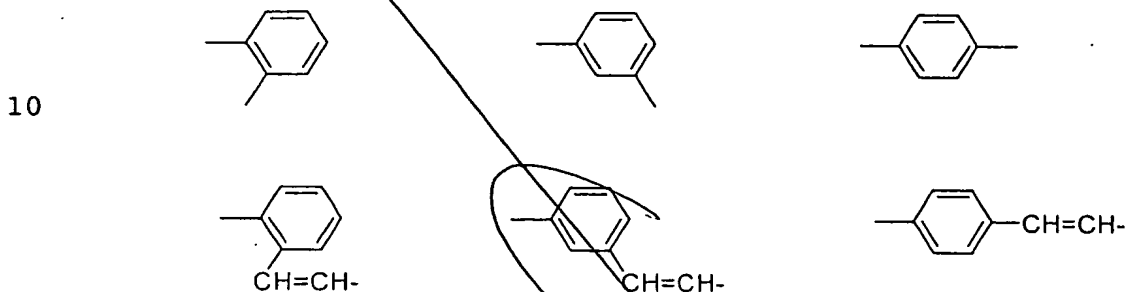
(I)

wherein

$R_1$ ,  $R_2$ , and  $R_3$  are each independently a hydrogen atom, an alkyl group having 1 to 5 carbons, or an alkoxy group having 1 to 5 carbons;

$R_4$  is a hydrogen atom, a hydroxymethyl group, an alkyl group, or a carboxyl group which is optionally esterified or amidated;

$Z$  is

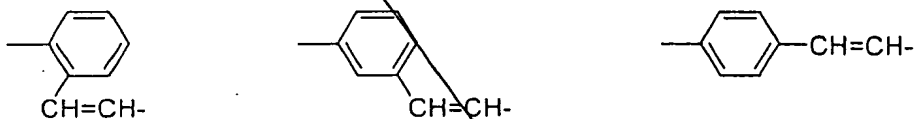


and,  $n$  is an integer from 0 to 6, or its hydroquinone form, or a pharmaceutically acceptable salt thereof.

17. ~~The inhibitor of TNF- $\alpha$  production~~ <sup>inhibitor composition</sup> according to claim 16 ~~in which~~ <sup>wherein</sup>  $R_1$  and  $R_2$  are a hydrogen atom, a methyl group, or a methoxy group.

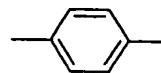
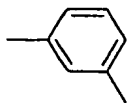
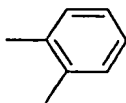
18. ~~The inhibitor of TNF- $\alpha$  production~~ <sup>inhibitor composition</sup> according to claim 16 ~~or 17 in which~~ <sup>wherein</sup>  $R_3$  is a hydrogen atom or a methyl group.

19. ~~The inhibitor of TNF- $\alpha$  production~~ <sup>inhibitor composition</sup> according to claim 16, ~~17, or 18 in which~~ <sup>wherein</sup>  $Z$  is



and  $n$  is an integer 0.

20. ~~The inhibitor of TNF- $\alpha$  production~~ <sup>inhibitor composition</sup> according to claim 16, 17, ~~or 18 in which~~ <sup>wherein</sup>  $Z$  is



and n is an integer 1, 2, or 3.

21. The ~~inhibitor of~~ <sup>inhibitor composition</sup> TNF- $\alpha$  production according to ~~any one of claims 16 to 20~~ <sup>wherein</sup> in which  $R_4$  is a group  $-COOR_5$ , wherein  $R_5$  is a hydrogen atom, an optionally substituted alkyl group having 1 to 8 carbons, an optionally substituted phenyl group, or an optionally substituted aralkyl group having 7 to 11 carbons.

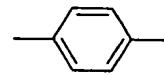
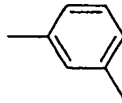
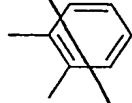
22. The ~~inhibitor of~~ <sup>inhibitor composition</sup> TNF- $\alpha$  production according to ~~any one of claims 16 to 20~~ <sup>wherein</sup> in which  $R_4$  is a group  $-CONR_6R_7$ , wherein  $R_6$  and  $R_7$  are each independently a hydrogen atom, an optionally substituted alkyl group having 1 to 8 carbons, an optionally substituted bicyclic unsaturated or partially saturated hydrocarbon ring group having 9 to 11 carbons, an optionally substituted heterocyclic group, an optionally substituted phenyl group, an optionally substituted aralkyl group having 7 to 11 carbons, or a heteroaryl- $C_1$ - $C_3$ -alkyl group, or  $R_6$  and  $R_7$ , together with the nitrogen atom to which they are attached, represent a heterocyclic group which may further contain a nitrogen, oxygen, and/or sulfur atom.

23. The ~~inhibitor of~~ <sup>inhibitor composition</sup> TNF- $\alpha$  production according to ~~any one of claims 16 to 20~~ <sup>wherein</sup> in which  $R_4$  is a group  $-CONR_6R_7$ , wherein  $R_6$  and  $R_7$ , together with the nitrogen atom to which they are attached, represent a 5- to 10-membered optionally substituted, nitrogen-containing heterocyclic group which may contain, in addition to the carbon and nitrogen atom, 1 to 3 heteroatoms selected from the group consisting of a nitrogen, oxygen and sulfur atom, the carbon atom on said cyclic group being optionally a ketone form or the sulfur atom on said cyclic group being optionally an oxide form.

24. The ~~inhibitor of~~ <sup>inhibitor composition</sup> TNF- $\alpha$  production according to

wherein

Claim 16, ~~21, 22, or 23 in which~~ <sup>wherein</sup> R<sub>1</sub> and R<sub>2</sub> are a methyl group or a methoxy group; R<sub>3</sub> is a methyl group; R<sub>4</sub> is a carboxyl group which is optionally esterified or amidated; Z is



and n is an integer 1, 2, or 3.

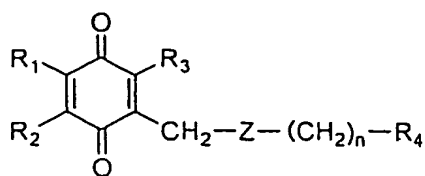
25. The ~~inhibitor of~~ <sup>inhibitor composition</sup> TNF- $\alpha$  production according to ~~any one of claims 16 to 24 which is a~~ <sup>wherein the</sup> suppressing agent for the gene expression of one or more substances <sup>is</sup> selected from the group consisting of IL-1, TNF- $\alpha$ , IL-2, IL-6, IL-8, iNOS, granulocyte colony-stimulating factor, interferon- $\beta$ , ICAM-1, VCAM-1, ELAM-1, plasminogen activator-inhibiting factor I, major histocompatibility system class I, major histocompatibility system class II,  $\beta$ 2-microglobulin, immunoglobulin light chain, serum amyloid A, angiotensinogen, complement B, complement C4, c-myc, HIV, HTLV-1, SV40, CMV, and adenovirus.

26. The ~~inhibitor of~~ <sup>inhibitor composition</sup> TNF- $\alpha$  production according to ~~any one of claims 16 to 24 which is a~~ preventive or therapeutic agent for inflammatory diseases.

27. The ~~inhibitor of~~ <sup>inhibitor composition</sup> TNF- $\alpha$  production according to ~~any one of claims 16 to 24 which is a~~ preventive or therapeutic agent for autoimmune diseases.

28. The ~~inhibitor of~~ <sup>inhibitor composition</sup> TNF- $\alpha$  production according to ~~any one of claims 16 to 24 which is a~~ preventive or therapeutic agent for viral diseases.

29. A preventive or therapeutic agent for diseases caused by the excessive production of TNF- $\alpha$  comprising as an active ingredient a benzoquinone derivative represented by the following general formula (1):



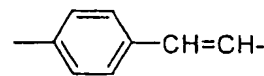
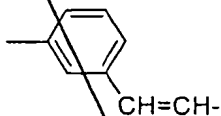
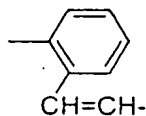
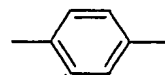
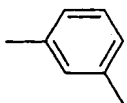
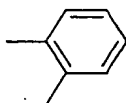
(I)

wherein

$\text{R}_1$ ,  $\text{R}_2$ , and  $\text{R}_3$  are each independently a hydrogen atom, an alkyl group having 1 to 5 carbons, or an alkoxy group having 1 to 5 carbons;

$\text{R}_4$  is a hydrogen atom, a hydroxymethyl group, an alkyl group, or a carboxyl group which is optionally esterified or amidated;

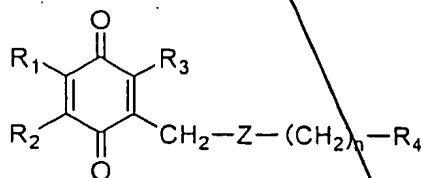
Z is



and,  $n$  is an integer from 0 to 6,

or its hydroquinone form, or a pharmaceutically acceptable salt thereof.

30. A benzoquinone derivative represented by the following general formula (1):



(I)

wherein

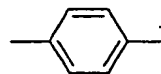
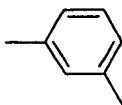
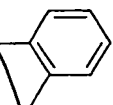
$\text{R}_1$ ,  $\text{R}_2$ , and  $\text{R}_3$  are each independently a hydrogen atom, an alkyl group having 1 to 5 carbons, or an alkoxy group having 1 to 5 carbons;

$\text{R}_4$  is a hydrogen atom, a hydroxymethyl group, an alkyl group, or a carboxyl group which is optionally

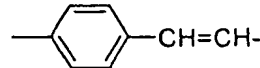
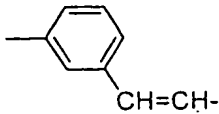
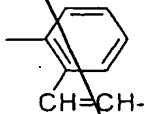
esterified or amidated;

Z is

5

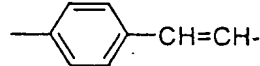
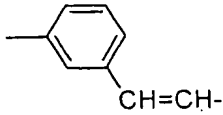
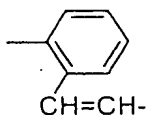


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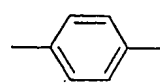
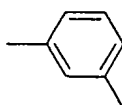
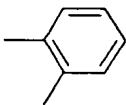
and, n is an integer from 0 to 6,  
provided that when Z is

15



n is not 0, and when Z is

20



n is neither 0 nor 2,  
or its hydroquinone form, or a pharmaceutically  
acceptable salt thereof.

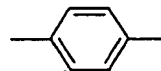
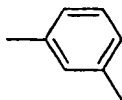
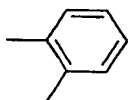
25

31. The benzoquinone derivative according to claim  
30 wherein  $R_1$  and  $R_2$  are a hydrogen atom, a methyl  
group, or a methoxy group, or its hydroquinone form or a  
pharmaceutically acceptable salt thereof.

30

32. The benzoquinone derivative according to claim  
30 wherein  $R_3$  is a hydrogen atom or a methyl  
group, or its hydroquinone form or a pharmaceutically  
acceptable salt thereof.

33. The benzoquinone derivative according to claim  
30 wherein Z is



5 and n is an integer 1 or 3, or its hydroquinone form or a pharmaceutically acceptable salt thereof.

a 34. The benzoquinone derivative according to ~~any one of claims 30 to 33~~ <sup>wherein</sup> in which  $R_4$  is a group  $-COOR_5$ ,  
10 wherein  $R_5$  is a hydrogen atom, an optionally substituted alkyl group having 1 to 8 carbons, an optionally substituted phenyl group, or an optionally substituted aralkyl group having 7 to 11 carbons, or its hydroquinone form or a pharmaceutically acceptable salt thereof.

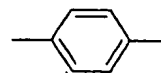
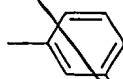
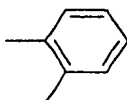
a 35. The benzoquinone derivative according to ~~any one of claims 30 to 33~~ <sup>wherein</sup> in which  $R_4$  is a group  $-CONR_6R_7$ ,  
15 wherein  $R_6$  and  $R_7$  are each independently a hydrogen atom, an optionally substituted alkyl group having 1 to 8 carbons, an optionally substituted bicyclic unsaturated or partially saturated hydrocarbon ring group having 9 to  
20 11 carbons, an optionally substituted heterocyclic group, an optionally substituted phenyl group, an optionally substituted aralkyl group having 7 to 11 carbons, or a heteroaryl- $C_1$ - $C_3$ -alkyl group, or  $R_6$  and  $R_7$ , together with the nitrogen atom to which they are attached, represent a  
25 heterocyclic group which may further contain a nitrogen, oxygen and/or sulfur atom, or its hydroquinone form or a pharmaceutically acceptable salt thereof.

a 36. The benzoquinone derivative according to ~~any one of claims 30 to 33~~ <sup>wherein</sup> in which  $R_4$  is a group  $-CONR_6R_7$ ,  
30 wherein  $R_6$  and  $R_7$ , together with the nitrogen atom to which they are attached, represent a 5- to 10-membered optionally substituted, nitrogen-containing heterocyclic group which may contain, in addition to the carbon and nitrogen atom, 1 to 3 heteroatoms selected from the group  
35 consisting of a nitrogen, oxygen and sulfur atom, the carbon atom on said cyclic group being optionally a ketone form or the sulfur atom on said cyclic group being

optionally an oxide form, or its hydroquinone form or a pharmaceutically acceptable salt thereof.

a 37. The benzoquinone derivative according to claim 30, <sup>wherein</sup> ~~34, 35, or 36~~ in which R<sub>1</sub> and R<sub>2</sub> are a methyl group or a methoxy group; R<sub>3</sub> is a methyl group; R<sub>4</sub> is a carboxyl group which is optionally esterified or amidated; Z is

10



and n is an integer 1 or 3, or its hydroquinone form or a pharmaceutically acceptable salt thereof.

add  
D5

add  
G1